



# GP400LSS18

## Single Switch IGBT Module

DS5305-2.0 November 2000

### FEATURES

- Non Punch Through Silicon
- Isolated Copper Baseplate
- Low Inductance Internal Construction
- 400A Per Module

### APPLICATIONS

- High Power Inverters
- Motor Controllers
- Induction Heating
- Resonant Converters

The Powerline range of high power modules includes half bridge, dual and single switch configurations covering voltages from 600V to 3300V and currents up to 4800A.

The GP400LSS18 is a single switch 1800V, n channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) ensuring reliability in demanding applications.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise earthed heat sinks for safety.

### ORDERING INFORMATION

Order As:

**GP400LSS18**

Note: When ordering, please use the whole part number.

### KEY PARAMETERS

$V_{CES}$		<b>1800V</b>
$V_{CE(sat)}$	(typ)	<b>3.5V</b>
$I_C$	(max)	<b>400A</b>
$I_{C(PK)}$	(max)	<b>800A</b>

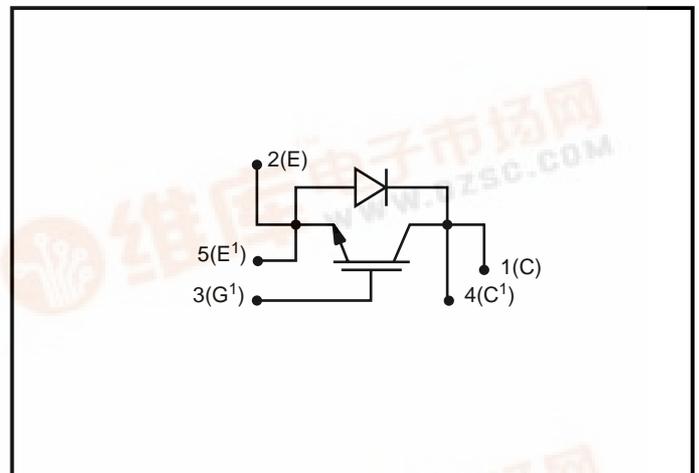


Fig. 1 Single switch circuit diagram

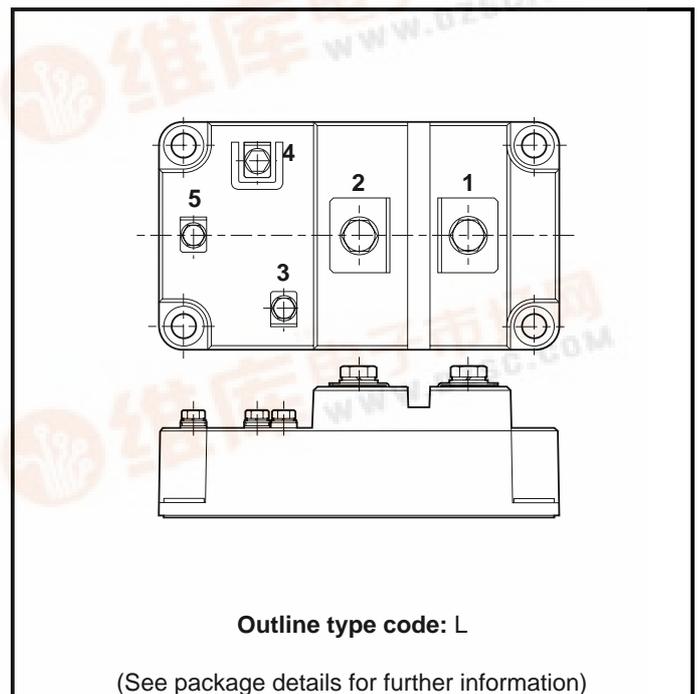


Fig. 2 Electrical connections - (not to scale)

## ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

$T_{case} = 25^{\circ}\text{C}$  unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
$V_{CES}$	Collector-emitter voltage	$V_{GE} = 0\text{V}$	1800	V
$V_{GES}$	Gate-emitter voltage	-	$\pm 20$	V
$I_C$	Continuous collector current	DC, $T_{case} = 75^{\circ}\text{C}$	400	A
$I_{C(PK)}$	Peak collector current	1ms, $T_{case} = 80^{\circ}\text{C}$	800	A
$P_{max}$	Max. power dissipation	$T_{case} = 25^{\circ}\text{C}$ (Transistor), $T_j = 150^{\circ}\text{C}$	2980	W
$V_{isol}$	Isolation voltage	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V

## THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Test Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - transistor	DC junction to case	-	40	$^{\circ}\text{C}/\text{kW}$
$R_{th(j-c)}$	Thermal resistance - diode	DC junction to case	-	70	$^{\circ}\text{C}/\text{kW}$
$R_{th(c-h)}$	Thermal resistance - case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	15	$^{\circ}\text{C}/\text{kW}$
$T_j$	Junction temperature	Transistor	-	150	$^{\circ}\text{C}$
		Diode	-	125	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature range	-	-40	125	$^{\circ}\text{C}$
-	Screw torque	Mounting - M6	-	5	Nm
		Electrical connections - M4	-	2	Nm

**ELECTRICAL CHARACTERISTICS**
 $T_{case} = 25^{\circ}\text{C}$  unless stated otherwise.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$I_{CES}$	Collector cut-off current	$V_{GE} = 0\text{V}, V_{CE} = V_{CES}$	-	-	1	mA
		$V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_{case} = 125^{\circ}\text{C}$	-	-	10	mA
$I_{GES}$	Gate leakage current	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}$	-	-	$\pm 2$	$\mu\text{A}$
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 40\text{mA}, V_{GE} = V_{CE}$	4	-	7.5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{V}, I_C = 400\text{A}$	-	3.5	4.0	V
		$V_{GE} = 15\text{V}, I_C = 400\text{A}, T_{case} = 125^{\circ}\text{C}$	-	4.3	5.0	V
$I_F$	Diode forward current	DC	-	-	400	A
$I_{FM}$	Diode maximum forward current	$t_p = 1\text{ms}$	-	-	800	A
$V_F$	Diode forward voltage	$I_F = 4000\text{A}, T_{case} = 80^{\circ}\text{C}$	-	2.2	2.5	V
		$I_F = 400\text{A}, T_{case} = 125^{\circ}\text{C}$	-	2.3	2.6	V
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	45	-	nF
$L_M$	Module inductance	-	-	15	-	nH

**ELECTRICAL CHARACTERISTICS**

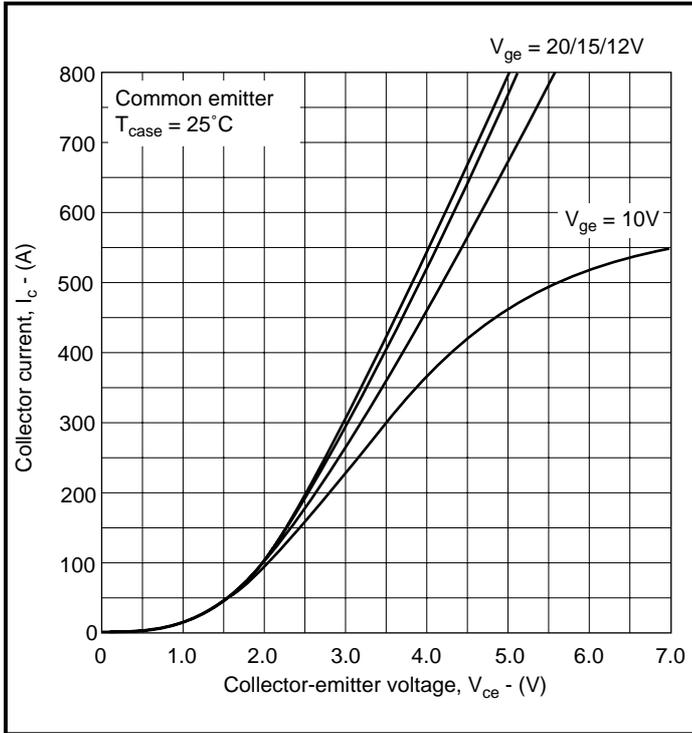
**T<sub>case</sub> = 25°C unless stated otherwise.**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
t <sub>d(off)</sub>	Turn-off delay time	I <sub>C</sub> = 400A	-	800	900	ns
t <sub>f</sub>	Fall time	V <sub>GE</sub> = ±15V	-	100	130	ns
E <sub>OFF</sub>	Turn-off energy loss	V <sub>CE</sub> = 900V	-	100	130	mJ
t <sub>d(on)</sub>	Turn-on delay time	R <sub>G(ON)</sub> = R <sub>G(OFF)</sub> = 4.7Ω	-	650	750	ns
t <sub>r</sub>	Rise time	L ~ 100nH	-	200	300	ns
E <sub>ON</sub>	Turn-on energy loss		-	100	150	mJ
Q <sub>rr</sub>	Diode reverse recovery charge	I <sub>F</sub> = 400A, V <sub>R</sub> = 900V, dI <sub>F</sub> /dt = 2500A/μs	-	80	100	μC

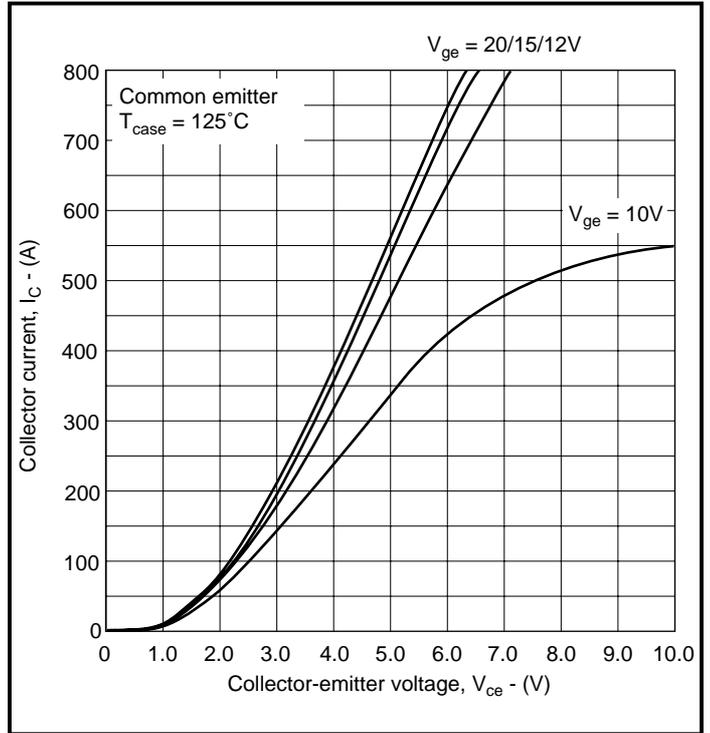
**T<sub>case</sub> = 25°C unless stated otherwise.**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
t <sub>d(off)</sub>	Turn-off delay time	I <sub>C</sub> = 400A	-	900	1100	ns
t <sub>f</sub>	Fall time	V <sub>GE</sub> = ±15V	-	150	200	ns
E <sub>OFF</sub>	Turn-off energy loss	V <sub>CE</sub> = 900V	-	120	150	mJ
t <sub>d(on)</sub>	Turn-on delay time	R <sub>G(ON)</sub> = R <sub>G(OFF)</sub> = 4.7Ω	-	900	1100	ns
t <sub>r</sub>	Rise time	L ~ 100nH	-	250	300	ns
E <sub>ON</sub>	Turn-on energy loss		-	170	210	mJ
Q <sub>rr</sub>	Diode reverse recovery charge	I <sub>F</sub> = 400A, V <sub>R</sub> = 900V, dI <sub>F</sub> /dt = 2500A/μs	-	130	160	μC

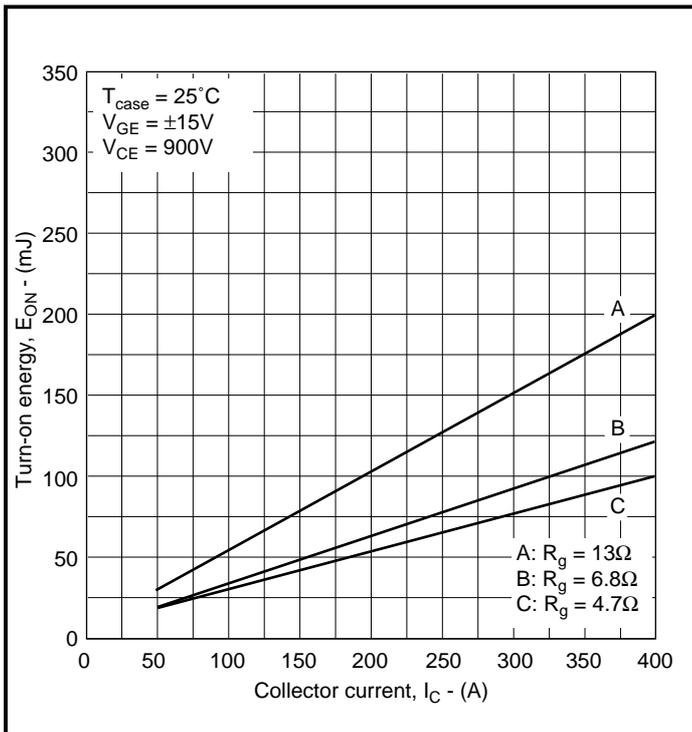
**TYPICAL CHARACTERISTICS**



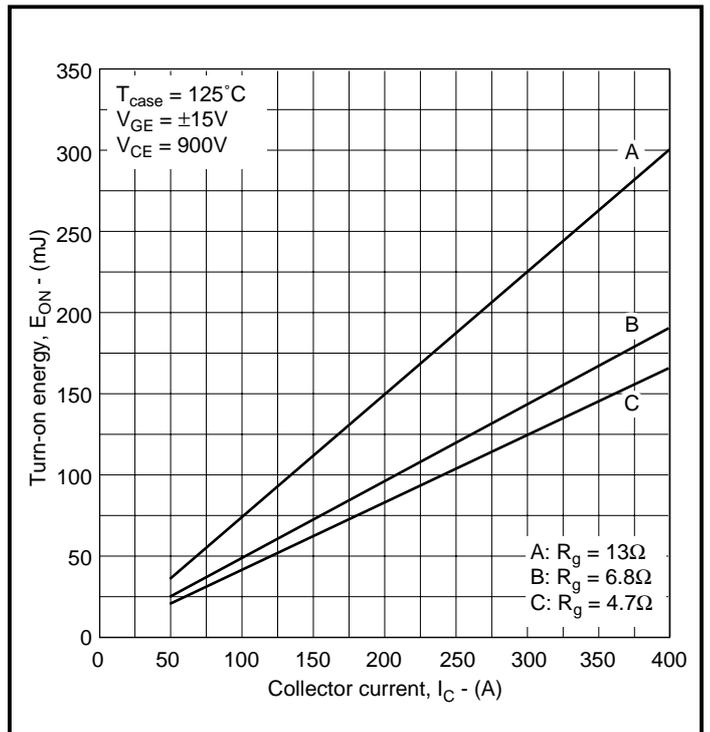
**Fig.3 Typical output characteristics**



**Fig.4 Typical output characteristics**



**Fig.5 Typical turn-on energy vs collector current**



**Fig.6 Typical turn-on energy vs collector current**

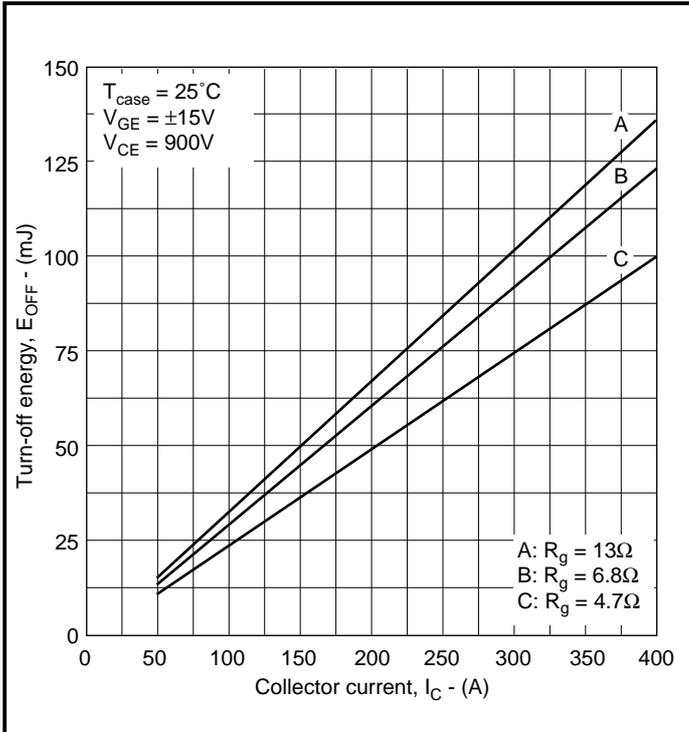


Fig.7 Typical turn-off energy vs collector current

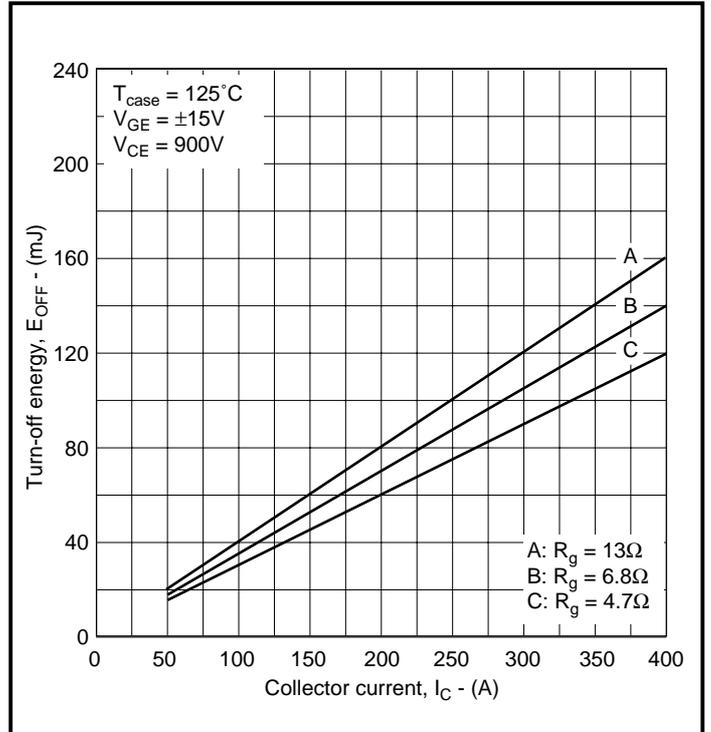


Fig.8 Typical turn-off energy vs collector current

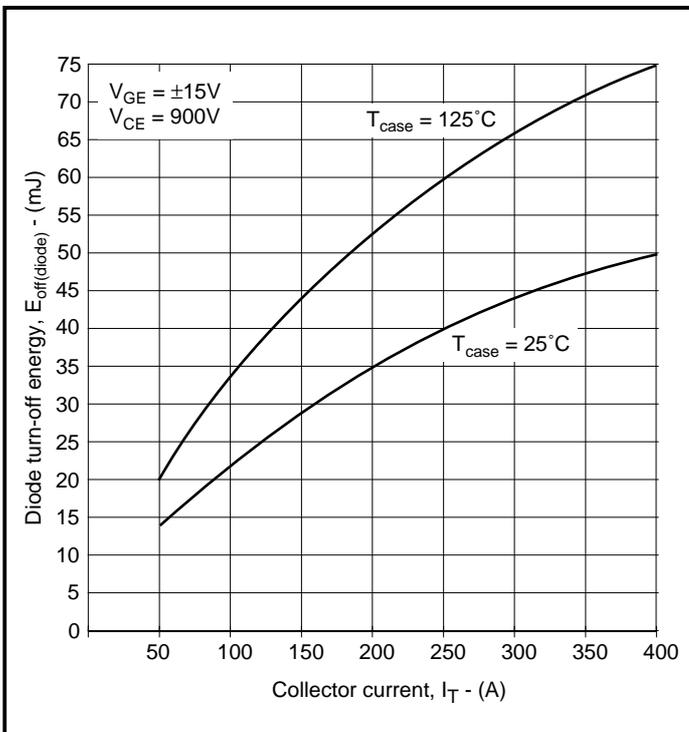


Fig.9 Typical diode reverse recovery charge vs collector current

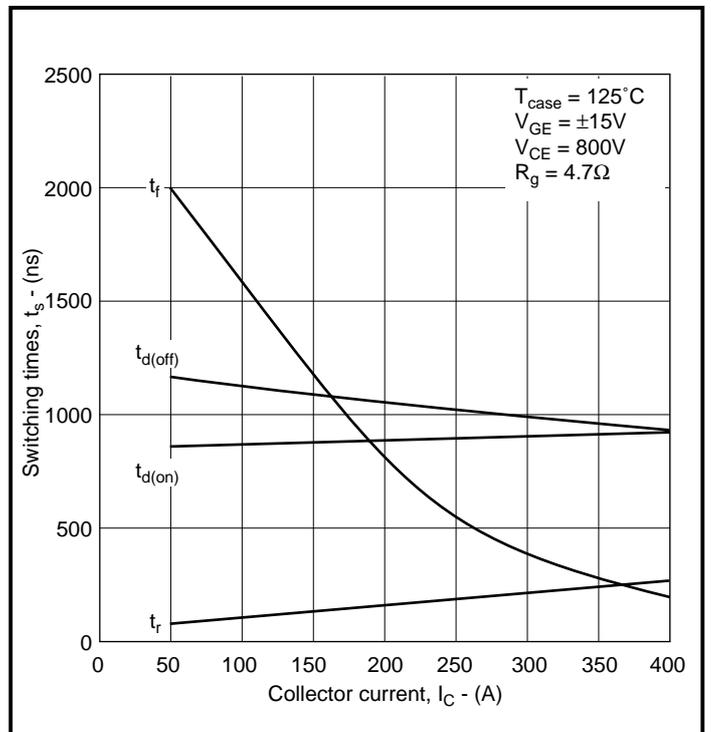
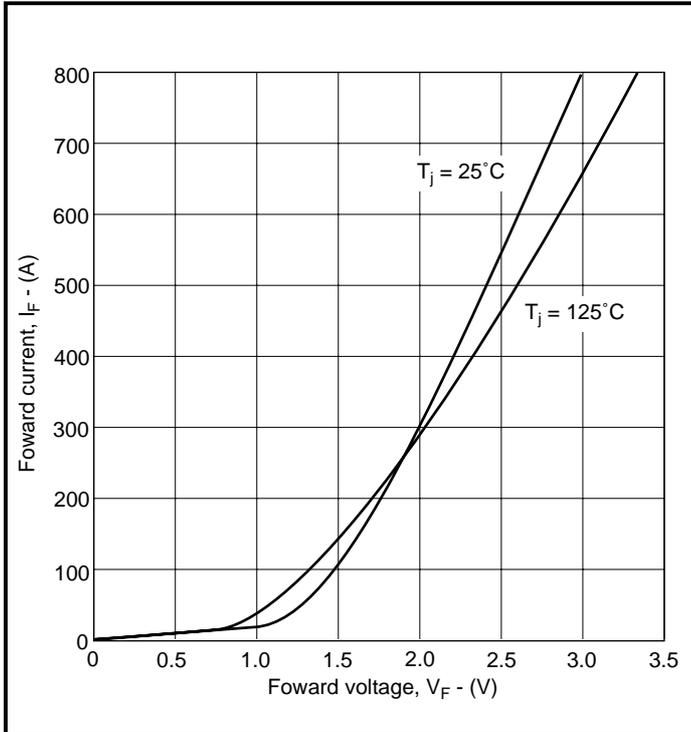
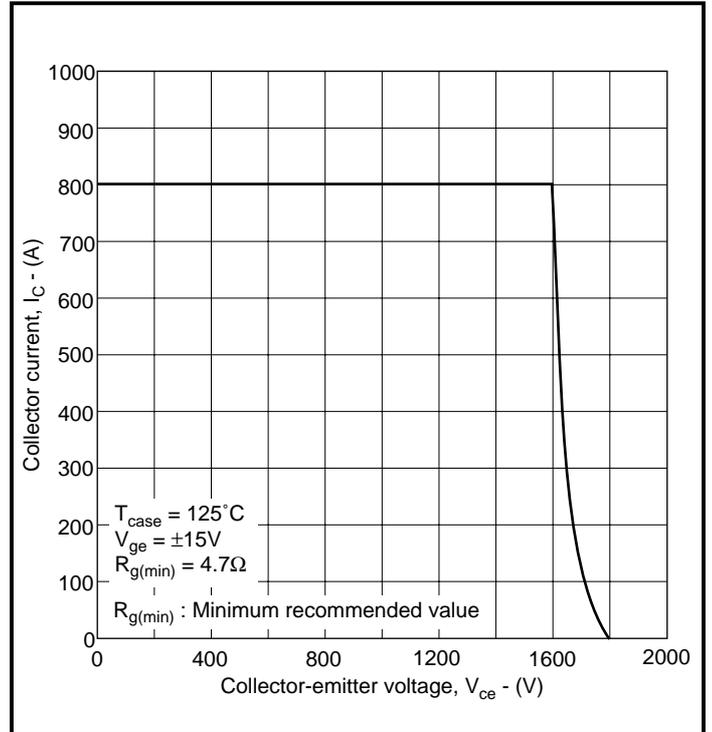


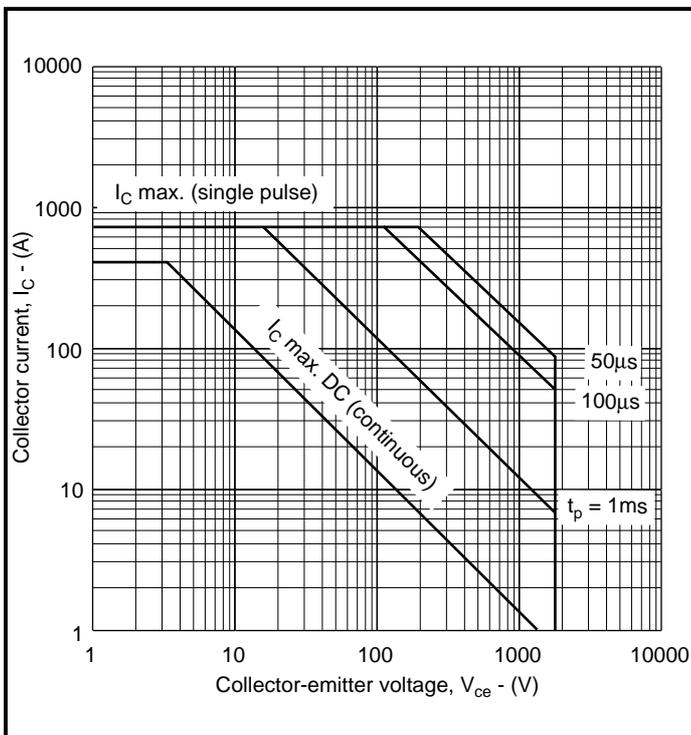
Fig.10 Typical switching characteristics



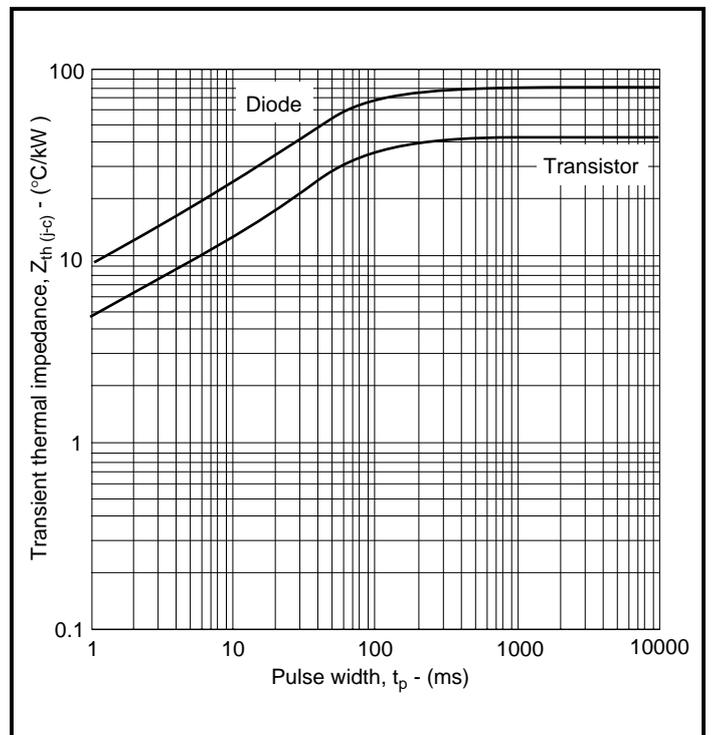
**Fig.11 Diode typical forward characteristics**



**Fig.12 Reverse bias safe operating area**



**Fig.13 Forward bias safe operating area**



**Fig.14 Transient thermal impedance**

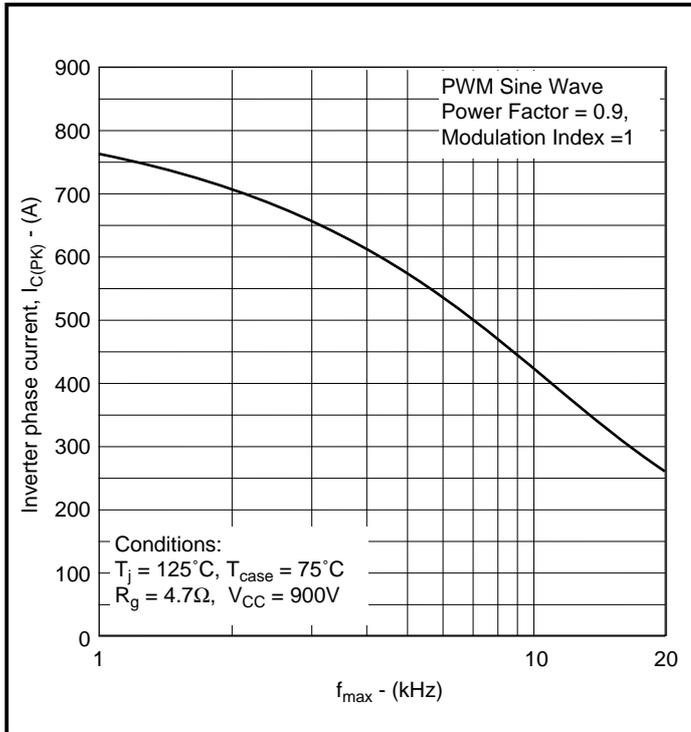


Fig.15 3-Phase inverter operating frequency

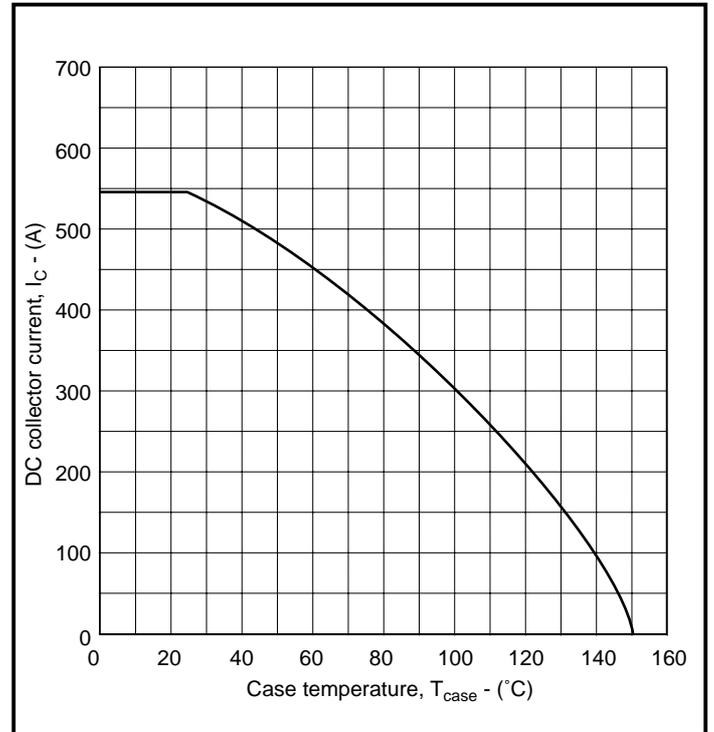
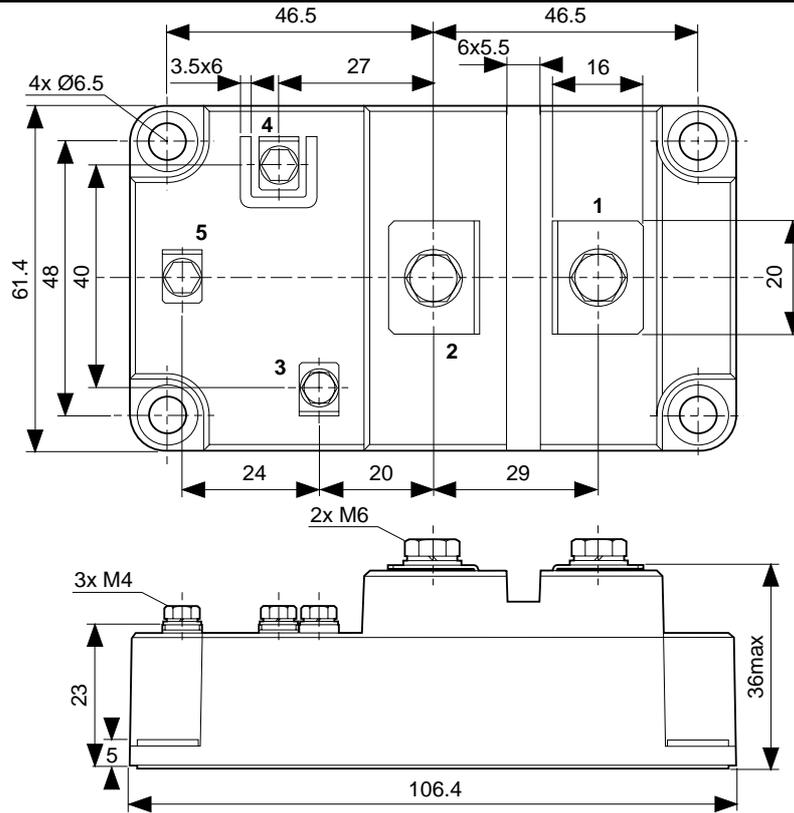


Fig.16 DC current rating vs case temperature

**PACKAGE DETAILS**

For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



Nominal weight: 270g  
 Recommended fixings for mounting: M6  
 Recommended mounting torque: 5Nm (44lbs.ins)  
 Recommended torque for electrical connections (M4): 2Nm (17lbs.ins)

**Module outline type code: L**

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**ASSOCIATED PUBLICATIONS**

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Title	Application Note
	Number
Electrostatic handling precautions	AN4502
An introduction to IGBTs	AN4503
IGBT ratings and characteristics	AN4504
Heatsink requirements for IGBT modules	AN4505
Calculating the junction temperature of power semiconductors	AN4506
Gate drive considerations to maximise IGBT efficiency	AN4507
Parallel operation of IGBTs – punch through vs non-punch through characteristics	AN4508
Guidance notes for formulating technical enquiries	AN4869
Principle of rating parallel connected IGBT modules	AN5000
Short circuit withstand capability in IGBTs	AN5167
Driving Dynex Semiconductor IGBT modules with Concept gate drivers	AN5384

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The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group continues to offer high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

**HEATSINKS**

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or customer service office.



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